

Remarks

This paper is submitted in response to the Non-Final Office action mailed on August 4, 2011. Claims 1, 11, 12, and 13 have been amended. After entry of this Response, claims 1-6 and 8-13 will be pending. Applicants aver that no new matter has been added by this amendment.

I. Claim Objections

Claims 12 and 13 have amended to correct informalities. In particular, claims 12 and 13 have amended as suggested to set forth the dependency from the non-transitory computer readable medium of claim 11. Accordingly, Applicants request that the objections to claims 12 and 13 be removed.

II. Claim Rejections Under 35 USC §112

Claims 1-6, 8-9, and 11-13 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 1 and 11 have been amended to have proper antecedent basis by replacing "the three dimensional model" with "a three dimensional model."

Claim 1 has also been amended to clarify the claimed subject matter by replacing "estimating displacement and distortion at a portion whose three-dimensional position is not known" with "estimating displacement and distortion at a portion in the three-dimensional model having a particular three-dimensional position". Accordingly, Applicants submit that amended claims 1 and 11 are in compliance with 35 U.S.C. § 112, second paragraph, and respectfully request that the rejection of these claims be removed.

Claims 2-6, 8-9, 12, and 13 are dependent claims and are in compliance with 35 U.S.C. § 112 for the same reasons as the base claims from which they depend.

III. Claim Rejections Under 35 USC §103

The Office action rejected claims 1-6 and 8-13 are rejected under 35 U.S.C. § 103 (a) as being unpatentable over Grimson et al. (U.S. Patent No. 5,999,840) (hereinafter Grimson) in view of Shahidi (U.S. Patent Application Pub No. 2001/001684) (hereinafter Shahidi) in view of Registration of 3-D Intraoperative MR Images of the Brain Using a Finite-Element Biomechanical Model to Matthieu Ferrant et al. (hereinafter Ferrant). Applicant respectfully traverses these rejections.

To reach a proper determination under 35 U.S.C. § 103, the examiner must step backward in time and into the shoes worn by the hypothetical "person of ordinary skill in the art" when the invention was unknown and just before it was made. In view of all factual information, the examiner must then make a determination whether the claimed invention "as a whole" would have been obvious at that time to that person. Knowledge of applicant's disclosure must be put aside in reaching this determination, yet kept in mind in order to determine the "differences," conduct the search, and evaluate the "subject matter as a whole" of the invention. (See MPEP 2142.) For at least the following reason, Applicants submit that the cited references, whether considered alone or in combination, render any of the independent claims obvious.

A. Claim 1 is not rendered obvious by Grimson, Shahidi, or Ferrant because whether consider alone or in combination the cited references do not disclose correcting a position of a portion whose three-dimensional position is known by the first position information and the second position information in the three-dimensional model of the operation site.

The Office action asserts that Grimson discloses a correction means that, based on the first position information acquired by said first acquisition means and the second position information acquired by said second acquisition means correcting a position of a portion whose three dimensional position is known by the first position information and the second position information in a three dimensional model of the operation site (see for example col. 6, lines 30-53)." (See Office action, page 5.) We respectfully disagree.

As described in the present application a plurality of high-definition tomographic images of an operation site produced before surgery and a three-dimensional model of the operation site is generated. Also, a surface of the operation site is optically measured during the surgical operation and first position information that represents a three-dimensional position of each of points on the surface of the operation site is acquired. Further, an unexposed portion of the operation site is measured with ultrasonic waves during the surgical operation, and the second position information that represents a three-dimensional position of each of points in the unexposed portion of the operation site is acquired. Based on the first position information and the second position information, displacement and distortion occurring at each of the points in the operation site are estimated using the generated three-dimensional model. In accordance with the estimated displacement and distortion occurring

at each of the points in the operation site, the plurality of high-definition tomographic images of the operation site produced before the surgical operation are corrected and the corrected high-definition tomographic images are displayed. (See Abstract.) To this end, claim 1 recites in part, "acquiring second position information representing a three-dimensional position of each of points in the unexposed portion of the operation site" and "correcting a position of a portion whose three-dimensional position is known by the first position information and the second position information in the three-dimensional model of the operation site." For at least the following reasons, Applicants respectfully submit that none of the cited references disclose, teach, or suggest such limitations.

Grimson discloses an image registration method and system for generating a composite or matched image that includes three-dimensional anatomical data (MRI, CT, etc.), three-dimensional skin surface data, which corresponds to the position of the patient, and data related to the position of a trackable probe to the three-dimensional skin surface data. For example, Grimson discloses a method and system for the registration of three-dimensional data sets including a first data set of 3D topographic images obtained before the operation, a second data set of 3D surface configuration data of the surgery environment, and a third data set of 3D images of the surgical instrument. The above data sets are mapped on the same three-dimensional coordinates and the images are superimposed upon on another.

As described in Grimson, a patient requiring surgical therapy is initially scanned by a three-dimensional, high resolution, internal anatomy scanner, such as Magnetic Resonance Imaging (MRI) or Computed Tomography (CT). The patient is then placed in an operating room, which is equipped with a laser range scanner for obtaining depth data of the patient's skin surface where the surgery is to be performed; and enhanced visualization equipment, such as a video or digital camera, mixer and display monitor, a head-mounted display with trackable landmarks, an operating room microscope with video projection overlay feed, along with microscope-mounted trackable landmarks, or transparent projection screens along with screen mounted trackable landmarks, medical instrument holders containing trackable landmarks.

Applicants submit that there is absolutely no disclosure in Grimson regarding correcting a position of a portion whose three-dimensional position is known by the first position information and the second position information in the three-dimensional model of the operation site. Correcting an image based on different types of data is not the same as

generating a composite image by superimposing different data types. In fact, the terms "correct" or "correcting" do not appear in Grimson.

Moreover, the Examiner also acknowledges that Grimson "does not teach that the second acquisition means measures an unexposed portion (within the brain) of the operation site." (See Office action, page 4.) Accordingly, because the unexposed portion is represented by the second position information, Grimson cannot teach a correction means that, based on the first position information acquired by said first acquisition means and the second position information acquired by said second acquisition means, correcting a position of a portion whose three-dimensional position is known by the first position information and the second position information in the three-dimensional model of the operation site.

Shahidi discloses a system and method for displaying 3D images of anatomical structures in real time during surgery to enable a surgeon to navigate through these structures during the performance of surgical procedures. (See Shahidi application, paragraph 14.) Shahidi also discloses that a position tracking system is connected both to the computer and also to surgical probes or other instruments that are used by the surgeon. The position tracking system provides continual real time data to the computer indicating the location and orientation of the surgical instrument in use. (See Shahidi application, paragraph 14.)

Shahidi further discloses that three-dimensional image scan data of the patient's head previously obtained from one or more of the techniques, such as CT, MIR and/or MRI scan techniques are loaded and stored into a computer memory. (See Shahidi application, paragraph 44.) Three-dimensional perspective image and 2D images can be displayed images and continually updated during the surgical procedure, and the resulting displays are constantly refreshed in real time. (See Shahidi application, paragraph 44 and 47.) Shahidi discloses using software that enables the user to overlay "actual images" generated, for example, by probes or instruments, such as ultrasound probes, endoscopes, or surgical microscopes used during surgery, with the "virtual images" generated from the scan data. (See Shahidi application, paragraph 18.)

However, Shahidi also fails to teach or suggest a correction means that, based on the first position information acquired by said first acquisition means and the second position information acquired by said second acquisition means and, thus, cannot remedy the deficiency of Grimson. Even if Shahidi discloses measuring an unexposed portion, this cited reference does not disclose any preoperative image correction. Rather Shahidi merely

discloses, enabling the user to overlay the "actual images" generated by these instruments with the "virtual images" generated from the scan data.

Ferrant does not remedy deficiencies of Grimson and Shahidi. As acknowledged by the Examiner, Ferrant uses software that tracks surface changes of an object along with a model that shows expected brain shifts based on surface changes. By tracking surface changes, expected internal brain deformations can be determined. In other words, Ferrant discloses using surface measurements to adjust preoperative images based on the expected brain deformations. This is not the same as the claimed correction means, which is based on first position data (surface data) and second position data (unexposed data). Thus, Ferrant also fails to teach or suggest a correction means that, based on the first position information acquired by said first acquisition means and the second position information acquired by said second acquisition means.

Independent claims 10 and 11 include similar limitations. Accordingly, the combination of Grimson, Shahidi, and Ferrant fails to teach and/or suggest each and every recited element of claims 1, 10, and 11 and, thus, cannot render claims 1, 10, and 11 obvious.

B. Ferrant teaches away from the claimed invitations.

Furthermore, regarding Ferrant we would suggest arguing that at least a portion of Ferrant teaches away from the claimed invention. According to U.S. patent law, "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention." *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984). The purpose of Ferrant is to update preoperative images during surgery for improving intraoperative navigation and tumor resection, and of reducing the amount of intraoperative imaging that is necessary. This is achieved using an algorithm for the nonrigid registration of three-dimensional magnetic resonance (MR) intraoperative image sequences showing brain shift. The algorithm tracks key surfaces of objects (cortical surface and the lateral ventricles) in the image sequence using a deformable surface matching algorithm. The volumetric deformation field of the objects is then inferred based on the surface data. We believe this teaches and/or leads away from "a second acquisition means for measuring an unexposed portion of the operation site with ultrasonic waves and during surgery, the unexposed portion of the operation site being below the surface of the operation site" and "correcting a position

of a portion whose three-dimensional position is known by the first position information and the second position information in the three-dimensional model of the operation site."

C. The Examiner did not consider all words in the claim.

Applicants further point out that "All words in a claim must be considered in judging the patentability of that claim against the prior art." (See MPEP 2143.03 citing *In re Wilson*, 424 F.2d 1382, 1385, 165 USPQ 494, 496 (CCPA 1970)). The words of the limitations as arranged in the claim must be identified in one or more cited references or a modification to the cited reference must be demonstrated by the examiner to meet the words of the limitations as arranged in the claim. In either instance, a reason to make the combination or modification must be demonstrated. (See *Finisar Corp. v. DirecTV Group, Inc.*, 523 F.3d 1323, 1335 (Fed. Cir. 2008), *Net MoneyIn, Inc. v. Verisign, Inc.* U.S. App. LEXIS 21827 (Fed Cir. 2008), and MPEP 2143.) The Examiner did not consider all words in the claim when judging the patentability against the prior art.

In particular, the Examiner failed to consider the all the words in the following limitations:

"second acquisition means for measuring an unexposed portion of the operation site with ultrasonic waves and without magnetic resonance imaging during surgery, the unexposed portion of the operation site being below the surface of the operation site" and "correction means for, based on the first position information acquired by said first acquisition means and the second position information acquired by said second acquisition means, correcting a position of a portion whose three-dimensional position is known by the first position information and the second position information in the three-dimensional model of the operation site."

As discussed above, Grimson, Shahidi, and Ferrant all fail to teach or suggest a correction means that, based on the first position information acquired by said first acquisition means AND the second position information acquired by said second acquisition means. Accordingly, we do not believe that the cited references cannot be demonstrated to meet the words of the limitations as arranged in the claim.

B. Dependent claims 2-6, 8-9, 12, and 13 are not obvious in view of Grimson, Shahidi, and Ferrant.

Claims 2-6 and 8-9 depend from claim and claims 12 and 13 depend from claim 11. A dependent claim incorporates each of the claim elements of the independent claim it

properly depends from. Therefore, Applicant respectfully submits that claims 2-6, 8-10, 12, and 13 are patentable at least due to their dependence on an allowable base claim.

IV. Conclusion

Applicant thanks the Examiner for his thorough review of the application. Additionally, Applicant submits the present application, as amended, is in condition for allowance and respectfully requests the issuance of a Notice of Allowability as soon as practicable.

Applicant's attorney welcomes the opportunity to discuss the case with the Examiner in the event that there are any questions or comments regarding the response or the application. This is intended to be a complete response to the Examiner's Office Action mailed on August 4, 2011.

A three-month extension fee has been included with this filing. Please consider this a petition for extension of time under 37 C.F.R. §1.136 for any required extension period, if any. Charge any additional fees associated with this paper, or credit any overpayment, to Deposit Account No. 50-1662.

The Applicants believe no other fees or petitions are due with this filing. However, we hereby authorize the United States Patent and Trademark Office to charge any additional fees, which may be required or credit any overpayment, to Deposit Account 50-1662.

Respectfully submitted,

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